Indian Journal of Science and Technology Vol. 5 No. 2 (Feb 2012) ISSN: 0974- 6846

Structure of human errors in tasks of operators working in the control room of an oil refinery unit

Niloufar Shah Gholi-Nejad[1], Mohammad Javad Jafari[2]*, Mehran Ghalehnoi[3], Yadollah Mehrabi[4], Mohsen ghadiri[5] and Mahmood Nikbakht[6]

[1]*Department of Occupational Health Engineering, School of public Health, International branch of Shahid Beheshti University of Medical Sciences and Health Services*
[2]*Occupational Health Engineering Department, Faculty of Health, Shahid Beheshti University of Medical Sciences, Tehran, Iran*
[3]*Department of Occupational Health, Faculty Member, Qazvin University of medical science, Qazvin, Iran*
[4]*Department of Epidemiology, School of Public Health, Shahid Beheshti University of Medical Sciences, Tehran, Iran*
[5]*Sharif university of technology, Strategic management PHD*
[6] *Department of Environmental* Science*, Science and Research Branch, Islamic Azad University, Tehran, Iran*
Jafari1952@yahoo.com*

Abstract

In the present research, human errors existed in tasks of operators working in two control rooms (Northern and Southern control rooms) in the Tehran oil refinery are identified and evaluated. Then, corrective strategies and actions are advised to decrease errors. At first, using hierarchical task analysis (HTA) method, four positions including shift controller, head operators, control room's operators, and outside operators are analyzed. Afterwards, human errors in the considered positions are identified and assessed using technique for retrospective and predictive analysis of cognitive errors (TRACEr). Results present 670 internal errors and 738 external errors in the Northern sector while 661 internal errors and 744 external errors in the Southern sector. In two sectors, this number of errors was identified for 27 major tasks and 108 minor tasks. Action errors are the most repeated errors among the internal errors while violation errors are the least. In addition, most of external errors are related to communication errors while the least errors are related to time and sequence errors. According to results of applying psychological error mechanism (PEM) in the considered positions, people's distraction is the main factor causing errors. Performance shaping factors (PFS) identifies lack of training as the major factor for errors. Using TRACEr, all external and internal errors, psychological error mechanism, and primary factors of errors in the control room can be detected.

Keywords: Operator; Human error; TRACEr; HTA, Tehran Oil Refinery.

Introduction

Studies indicate that human errors are the direct and indirect factors of 90% of all industrial accidents (Reason, 1990). Accident related to human errors can incur much financial losses and fatality. According to current statistics, in the late 30 years, 75 out of 157 accidents in the oil and gas offshore facilities have led to fire, financial losses, and casualties equal to 3 billion dollars and 187 dead. 34% of these accidents were due to human errors and 38% was due to inappropriate maintenance of equipment (ICSO, 2004a). The largest recorded disaster originated from human errors is a broad fire in Britain offshore oil rig platform in the Northern Sea, Piper Alpha, occurred in 6 July 1988, ICSO (2004b). The fire which was ignited by exit of gas condensates from one of the pipes of condensers of gas unit led to a chain of explosions and fire which finally resulted in destruction of whole platform and facilities ICSO (2004b). Some terrible accidents such as explosion in Flixborough (1974), airplane crash in Tenerife (1977), accident in Three Mile Island's nuclear power plant (1979), Bhopal's factories in India (1984), explosion of space shuttle Challenger (1986), Chernobyl's nuclear explosion (1986), and troubles in work of Mir space station (1998) could show the important role of human errors in happening of industrial disasters.

Basically, human beings play critical roles in oil and gas processes with high risk of fire and explosion (Zarei, 2009). In addition, as mentioned, human errors contribute much in accidents and disasters. Thus, prediction and identification of factors leading to human errors in the oil and gas industry can contribute much in improving the safety of such system and decrease in the industrial hazards. Tehran oil refinery with daily production capacity of 350,000 barrels is one of the largest refineries in Iran. In addition, Tehran oil refinery is one of the oldest facilities with 40 years of existence. This refinery is located in south edge of metropolitan Tehran. So, any disastrous event in this refinery could result in huge financial losses and fatalities. Therefore, studying different aspects of safety in this facility is the main focus of the present research. There are numerous techniques for identification of human errors. One of the major methods is technique for retrospective and predictive analysis of cognitive errors (TRACEr) which was originally developed by British national service of air traffic to classify human errors and identify their causes in the traffic control sector (RSSB, 2005; Shorrock, 2002). TRACEr, mainly based on human factors, analyzes human errors through hierarchical task analysis (HTA) approach and assists analyzer to realize the type and cause of the errors. In this method, external error modes